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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
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In the Matter of)
)
Amendment of the Commission's Rules)
to Establish New Personal)
Communications Services)

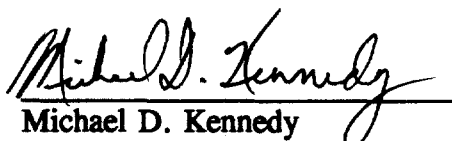
Gen Docket No. 90-314

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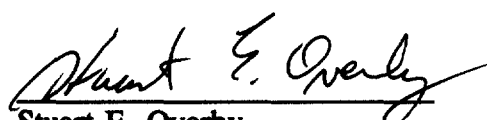
COMMENTS OF MOTOROLA, INC.

Motorola, Inc. (hereinafter Motorola) submits its comments in response to several petitions for further reconsideration or clarification of the FCC's Memorandum Opinion and Order ("MO&O") in the above-captioned proceeding concerning the establishment of new personal communications services ("PCS"). Although these pleadings may raise some interesting academic issues, none present arguments that support significant modification of the MO&O. Motorola therefore urges the FCC to proceed expeditiously in addressing the pending petitions so that the licensing process for broadband PCS may commence and the American public can begin receiving the benefits of this exciting new service.

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I. INTRODUCTION AND SUMMARY

After nearly five years of almost unparalleled debate, the FCC has successfully finalized a regulatory structure conducive to creating a thriving PCS industry that is technically capable of offering competitive and alternative wireless services to consumers. From a technical perspective, the refinements adopted in the recently released Memorandum Opinion and Order ("MO&O")¹ clearly maximize the opportunity for the PCS market to develop in a logical and coherent manner.

For example, the decision to focus the initial PCS spectrum allocation entirely within the 1850-1990 MHz band -- a proposal originally advanced by Motorola -- eliminates the propagation disparity inherent in the previous decision to bifurcate the allocation and thus ensures a more level playing field among PCS participants. Perhaps more importantly, as noted by the Commission, it will allow the aggregation of spectrum by a single service provider without the need for dual-band equipment.

Likewise, the decision to allow for increased radiated power levels for PCS base stations will allow PCS operators to provide far more effective and economic communications services. Motorola believes that this decision will also allow for continued development of so-called "smart antennas" -- actually dynamically steerable arrays -- that focus PCS signals to provide maximum coverage.

The vast majority of the communications industries -- including most of the mobile satellite service providers -- strongly support the Commission's actions taken in

¹ Memorandum Opinion and Order, GEN Docket No. 90-314, released June 13, 1994.

the MO&O and Motorola thus urges the FCC to resolve expeditiously the few remaining issues that stand in the way of the auction process and the provision of the service to the public. Motorola has reviewed all of the pending petitions for further reconsideration and has concluded that the challenges presented therein are neither daunting nor novel. The public interest demands a speedy resolution so that the wireless era of the information age may commence.

Nonetheless, Motorola would like to provide the Commission with its comments on the further reconsideration petitions that focus on the more technical issues in this proceeding. First, Motorola would like to address the Joint Request for Clarification filed by various broadcast interests headed by the Association of Maximum Service Television ("MSTV").² This pleading expresses concern about interference from "high-powered" PCS base stations to broadcast auxiliary receivers operating in adjacent spectrum at 1990-2110 MHz and argues against reallocation of the broadcast auxiliary spectrum. In short, Motorola finds this pleading largely to contain premature arguments that are better left for the future proceeding investigating the need for additional mobile satellite service ("MSS") spectrum. Also, Motorola rejects the call for any "guard band" between PCS and broadcast auxiliary stations.

² Joint Request for Clarification of the Association for Maximum Service Television, Inc., Capital Cities/ABC, Inc., CBS Inc., Fox, Inc. & Fox Broadcasting Stations, Inc., National Association of Broadcasters, National Broadcasting Company, Inc., Public Broadcasting Service, Radio-Television News Directors Association, Society of Broadcast Engineers, Inc, GEN Docket No. 90-314 (filed July 25, 1994) ["MSTV Clarification Request"].

Second, Motorola addresses the joint pleading submitted by Spatial Communications, Inc. and ArrayComm, Inc. that focuses on the maximum permitted radiated power for PCS base stations.³ To the extent that it fully comprehends the relief requested in this pleading, Motorola would support some clarification consistent with the themes expressed therein. Finally, Motorola addresses the Petition for Reconsideration filed by Omnipoint Corporation as it relates to unlicensed PCS devices and the proper techniques for measuring PCS emissions.⁴

II. MSTV CLARIFICATION REQUEST

A. Overview

The MSTV Clarification Request is joined by eight other broadcast interests including all major television networks and trade associations. Although entitled a "request for clarification", the document appears to well understand the goals of the FCC and, instead, simply seeks modification of the PCS service rules. In particular, these broadcast interests seek to establish a guard band in the PCS spectrum from 1970-1990 MHz band to protect broadcast auxiliary receivers operating in the adjacent allocation from 1990-2110 MHz.⁵ The broadcast interests also argue against the

³ Petition for Further Reconsideration and Request for Clarification of Spatial Communications, Inc. and ArrayComm, Inc., GEN Docket No. 90-314 (filed July 25, 1994) ["ArrayComm Petition"].

⁴ Petition for Reconsideration, Omnipoint Corporation, GEN Docket No. 90-314 (filed July 25, 1994) [Omnipoint Petition].

⁵ MSTV Clarification Request at 6.

potential reallocation of the 1990-2110 MHz band from broadcast auxiliary use to an emerging technology such as the mobile satellite service ("MSS"). Specifically, the MSTV Clarification Request argues that: (1) the 1990-2110 MHz band is a poor choice for accommodating MSS, (2) in the event of reallocation, the FCC must ensure that adequate new spectrum be found for broadcast auxiliary uses and, (3) broadcasters must be compensated for relocating to alternative spectrum.⁶

In support of its recommendation for a guard band, the MSTV Clarification Request argues that the FCC's decision on reconsideration to allocate PCS spectrum entirely within the 1850-1990 MHz band and no longer reserve the 1970-1990 MHz band raises the issue of potential interference to adjacent broadcast auxiliary operations as an appropriate matter for further reconsideration.⁷ In addition, the broadcasters claim that the increased power levels afforded PCS base stations, also adopted upon reconsideration in the FCC's MO&O, further exacerbate the potential for interference.⁸

The MSTV Clarification Request attempts to demonstrate that the entire broadcast auxiliary spectrum is subject to deleterious interference from PCS base stations transmitters operating from 1970-1990 MHz. According to the Engineering Statement attached to the MSTV Clarification Request, PCS base stations operating with 1640 watts EIRP will cause "brute force overload" to broadcast auxiliary receivers

⁶ Id. at 8-15.

⁷ Id. at 3.

⁸ Id. at 6.

located in near proximity to PCS base stations.⁹ The Engineering Statement concludes that the potential for interference can be eliminated by either: (1) prohibiting high powered base station transmitters from operating within the 1970-1990 MHz band and instead allowing only low powered subscriber units, or, (2) requiring interservice coordination between PCS and broadcast auxiliary to prevent the location of a high powered PCS base station within 2 kilometers of a licensed broadcast auxiliary receiver.¹⁰

B. Motorola Response

The MSTV Clarification Request addresses two separate issues. The first relates to what steps are necessary in its view to prevent potential interference to broadcast auxiliary receivers. The second essentially defines preliminary broadcast positions on the potential reallocation of the 2 GHz broadcast auxiliary band to the mobile satellite service as contemplated in the FCC's MO&O.¹¹

Guard Band: Motorola believes that the MSTV Clarification Request overstates the probability for interference. Currently, the broadcast auxiliary service operates adjacent to fixed microwave stations licensed under Part 94 and Part 21 of the FCC's Rules. These microwave stations are permitted to operate with radiated powers

⁹ Statement of Dane E. Ericksen, Consulting Engineer, MSTV Clarification Request at 2.

¹⁰ *Id.* at 3.

¹¹ MO&O at ¶ 97.

in excess of that permitted to PCS service.¹² Despite these higher powers, these services apparently co-exist with the broadcast auxiliary service without a guard band or without required frequency coordination.¹³ Thus, the broadcasters have not demonstrated that their radio environment will significantly change with the reallocation of this spectrum for PCS. Therefore, their request for a "guard band" is unsupported.

According to the Engineering Statement attached to the MSTV Clarification Request, the principal interference threat to broadcast facilities is "brute force overload". While this interference mechanism may indeed occur at any antenna site containing multiple transmitters and receivers from various radio services, the number of instances where interference is likely to occur will be mitigated by the fact that: (1) the population of broadcast auxiliary receivers is fairly low due to the limited number of broadcast outlets, and (2) a majority of PCS base station transmitters will likely operate with radiated powers below 1640 watts.

The Engineering Statement also discusses the potential for interference from PCS out-of-band emissions that fall on channel with the broadcast auxiliary

¹² The maximum permitted EIRP for PCS base stations is +32 dBW. Section 94.73 of the Rules limits private radio microwave transmitters operating at 1850-1990 MHz to +45 dBW. Section 21.107 of the Commission's rules does not limit EIRP for common carrier microwave transmitters operating in the 2110-2130 MHz band but simply limits transmitter output power to 20 watts. Assuming the use of antennas having 25 to 30 dB of gain, the EIRP of such facilities can easily reach +45 dBW.

¹³ In addition, the required attenuation schedule for microwave facilities beyond the authorized bandwidth is not as "strict" as that required for PCS systems. See §94.71(a) of the FCC's rules. This casts doubt on the claims of the broadcasters that significant interference would occur from out-of-band PCS emissions. See page 6-7 infra.

receivers.¹⁴ This Engineering Statement opines that the interference problem is heightened by the fact that the PCS emission attenuation schedule is less than "strict". Motorola notes, however, that the PCS emission limits appear stricter than that required of broadcast auxiliary stations. For example, Section 74.637(a) applicable to television broadcast auxiliary stations requires only 35 dB of attenuation on any frequency removed from the assigned frequency by 100 to 150 percent of the authorized bandwidth. In contrast, MSTV's Engineering Statement chides the FCC for requiring PCS stations to attenuate out of band emissions by "only 73 dB", which is almost 10,000 times smaller than that required of broadcasters.

The relaxed attenuation schedule for broadcast auxiliary stations will result in broadcast facilities transmitting on the channel located at 1990-2008 MHz to place significant levels of energy within the PCS spectrum allocation. Thus, the MSTV proposal to require low power subscriber units within 1970-1990 MHz is unacceptable since PCS receivers listening for these subscriber transmissions would likely receive harmful interference from the barely attenuated transmissions from the broadcast auxiliary stations.

Nonetheless, should interference occur in isolated instances to broadcast auxiliary receivers from out-of-band PCS emissions, the MSTV Clarification Requests suggests that a possible remedy for this type of interference would be to reduce out-of-band emissions from the PCS transmitter on a case-by-case basis.¹⁵ Motorola notes

¹⁴ Engineering Statement at 3.

¹⁵ Engineering Statement at 3.

that the FCC has already considered this possibility in rule section 24.238(b) which states:¹⁶

When an emission outside of the authorized bandwidth causes harmful interference, the Commission, may, at its discretion, require greater attenuation than specified in this section.

Thus, one potential remedy for resolving specific instances of interference is already accommodated by the rules.

Motorola believes that the potential for out-of-band emission interference to broadcast auxiliary services is sufficiently low to allow individual operators to resolve any resulting problems on a case-by-case basis. Further, it may be appropriate for the broadcast community to begin cooperating with the PCS industry by providing an up-to-date and accurate data base of their existing and operational receiver locations. Several outlets for disseminating this information to all likely PCS operators currently exist including PCIA and UTAM. PCS is now at a stage where it has numerous options in the deployment of specific systems. Understanding the existing broadcast auxiliary environment is simply another step in the successful launching of this new service. The FCC should thus pursue a course of requiring cooperation among various radio services as opposed to adopting restrictive guard bands.

Future Spectrum Reallocations: Motorola believes that the arguments raised in this pleading are premature with respect to the anticipated MSS spectrum allocation proceeding. The Commission has not proposed or adopted any rule that would affect

¹⁶ 47 C.F.R. §24.238(b) of the Commission's rules.

the broadcaster's use of the 1990-2110 MHz band. Therefore, the broadcast interests are not prejudiced in any way by allowing the PCS industry to proceed with providing needed wireless services to the American public. The broadcasters will have more than ample opportunity to identify their needs in the future MSS spectrum allocation proceeding.¹⁷ Motorola therefore urges the FCC to dismiss this aspect of the MSTV Clarification Request as such issues are more properly addressed in a separate proceeding addressing the need for additional MSS spectrum.

III. ArrayComm Petition

A. Overview

The ArrayComm Petition concerns itself entirely with the issue of maximum permitted radiated power for PCS base stations. At the outset, the ArrayComm Petition claims that the Commission failed to address its previously filed comments it submitted after the release of the FCC's Second Report and Order in this proceeding

¹⁷ In like fashion, CELSAT, INC. filed a Petition for Partial Reconsideration in GEN Docket No. 90-314 that urges the FCC to "amend its reallocation of the Emerging Technologies ("ET") spectrum at 1970-1990 MHz to include a further *secondary* allocation for domestic Mobile Satellite Services" or, in the alternative, "clarify that such an additional secondary allocation may follow." Motorola submits that this matter also should be addressed in the separate proceeding concerning additional domestic and international spectrum for MSS. Indeed, CELSAT itself suggests that the FCC separate this matter from the PCS proceeding. (See, CELSAT Petition for Partial Reconsideration at n. 7.) Since CELSAT is proposing a secondary allocation that it claims would "not interfere with the intended primary PCS allocation" (CELSAT Petition at 4), the pending matter should not affect the PCS auction process.

and, thus, reconsideration is warranted if solely to address those previously filed comments.¹⁸

Turning to the particulars of its arguments, the ArrayComm Petition indicates support for increased PCS power levels but favors proposed rules that incorporate the concepts of "peak directional radiated power and average radiated power" from PCS base stations.¹⁹ The petition argues that highly directional or "smart antennas" are "an innovative technology that cannot be regulated according to standard "one-dimensional" power definitions."²⁰ Also, ArrayComm takes issue with the FCC's decision to adopt power levels in units of "watts per channel" rather than "watts per hertz." As adopted, ArrayComm argues that the rule favors the use of narrow-band RF channels over wide-band modulation schemes.²¹ In addition, the ArrayComm Petition argues that limiting base station output power to 100 watts impacts the use of smart antennas by "restricting the "broadcast" control channels that are fundamental for wireless communication protocols."²² Finally, the ArrayComm Petition states that, at a minimum, the FCC "should clarify that the adopted power limits apply to individual base station

¹⁸ ArrayComm Petition at 4.

¹⁹ Id. at 2.

²⁰ Id. at 5.

²¹ Id. at 5.

²² Id. at 6. Motorola assumes that the ArrayComm smart antenna design incorporates control channels that monitor subscriber radios throughout an omnidirectional service area of the antenna array and that the 100 watt output power limitation restricts the coverage of the control channel. This in turn would restrict the ultimate range of the highly directionalized smart antenna components.

transmitters without regard to the number of transmitters employed at each base station, the antenna element or elements to which each transmitter is connected, or the channels in which each transmitter is allowed to transmit."²³

B. Motorola Response

The ArrayComm Petition raises complicated technical issues at a time when the industry is fast finalizing equipment designs in anticipation of the spectrum auctions. Nonetheless, the Petition raises concepts that, in principal, Motorola might support. For example, ArrayComm seeks clarification that Motorola supports on the attribution of power in pulsed technologies such as TDMA. Likewise, the ArrayComm Petition argues for a revised interpretation of the term "base station" so that multiple transmitters could operate simultaneously on the same frequencies along different azimuths but each operating with the maximum permitted power of 100 watts. Although Motorola would read the rules to suggest that such operation is permissible and encouraged by the FCC, it would support additional clarification.

Motorola generally supports refining the PCS service rules to be consistent with the minimum relief suggested by the ArrayComm Petition. The FCC should clarify that the adopted power limits apply to individual base station transmitters without regard to the number of co-channel transmitters employed at each base station. With regard to further relief as recommended by ArrayComm, Motorola is still analyzing the ramifications of adopting a "watts per hertz" power standard and the effect that such a

²³ Id. at 6,7.

policy would have on the service to the public provided by various technologies expected to comprise PCS. Motorola will consider the other comments filed in response to this petition and attempt to finalize its recommendations in its replies to those comments.

IV. OMNIPPOINT PETITION

A. Overview

Omnipoint raises two issues in its petition. The first concerns the Listen Before Talk time window used for call set-up that is part of the technical standards for unlicensed PCS devices. Omnipoint argues that this time should be increased from 10 milliseconds to 20 milliseconds which they claim will better accommodate a higher category of vocoders and better facilitate interoperability between unlicensed and licensed PCS operations.²⁴ Omnipoint also raises the issue of the proper procedures for measuring out-of-band emissions of licensed PCS transmitters. Omnipoint argues that the Commission should distinguish between the measurement of out-of-band emissions and spurious emissions.²⁵ In so doing, Omnipoint provides a proposed revision to Section 24.238 that requires a resolution bandwidth of approximately 1 percent of the authorized bandwidth when measuring out-of-band emissions, while maintaining a 1 MHz resolution bandwidth for measuring spurious emissions.²⁶

²⁴ Omnipoint Petition at 2.

²⁵ Id. at 6.

²⁶ Id. at 8.

According to Omnipoint, this modification would conform the measurement practices for unlicensed and licensed PCS devices and facilitate interoperability between the two services.²⁷

V. Motorola Response

Listen Before Talk Time: Motorola has previously commented on this issue and again expresses its concern with increasing the scan time from 10 milliseconds to 20 milliseconds. The current "listen before talk" monitoring period of 10 milliseconds and the frame period of 10 milliseconds/X (where X is a positive whole number) were both chosen to accommodate many different technologies while promoting spectrum efficiency. Increasing this value to 20 milliseconds penalizes more narrow band technologies because many frequency windows must be monitored for the longer period. This will adversely impact spectrum access times and battery life of portable devices.

Motorola believes that air interface frame periods of 10 milliseconds are sufficient to support low bit rate advanced vocoders that typically utilize analysis intervals of 20 millisecond or more. Indeed, the vocoder speech analysis interval need not be the same as the frame period of the air interface transmissions. For example, GSM uses a 4.615 millisecond frame period and supports full (13kbps) and half-rate (approx. 6.5kbps) vocoders, well under the 32kbps ADPCM cited by Omnipoint as

²⁷ Id. at 6.

commonly promoted for unlicensed equipment. For these reasons, Motorola opposes increasing the listen before talk monitor period and frame period.

Out-of-Band Emissions: Motorola agrees with many of the arguments presented by Omnipoint. Motorola notes that the Commission's Errata to the MO&O provides additional clarification and flexibility with respect to these measurement procedures and may already accommodate Omnipoint's concerns.²⁸ Nonetheless, clarification as requested by Omnipoint may serve the public interest by eliminating any uncertainties with respect to the proper measurement standards. Motorola believes that reducing the resolution bandwidth of measurement devices when measuring out-of-band emissions will better provide the manufacturing community and the FCC with a better picture of a device's potential to create interference. Further, Motorola notes that this specific matter is being addressed in ANSI/IEEE C63-SC7 and the WINTest group of WINForum. The Commission should comport the plain language of its rules in this regard with the recommendations of these two groups.

VI. CONCLUSION

The FCC's Memorandum Opinion and Order regarding the establishment of new personal communications services is remarkable for its near unanimous approval by various industry sectors. The FCC is more than capable of swiftly dealing with the issues raised in the petitions for further reconsideration thus clearing the way for the landmark spectrum auctions for broadband PCS licenses. In order to maintain a

²⁸ Errata, GEN Docket No. 90-314 (released July 22, 1994).

schedule conducive with the public interest, the FCC should simply dismiss or defer as premature any arguments focusing on the future proceeding investigating MSS spectrum options at 2 GHz. Those pleadings are misplaced in this docket. Further, the FCC need not give serious consideration to a guard band between PCS and broadcast auxiliary facilities. The likelihood for widespread interference is low and certainly manageable on a case-by-case basis. Also, the Commission should investigate further the proposals proffered by ArrayComm and Omnipoint to ensure that technical standards do not unintentionally favor one technology over another. In that way, the Commission can be assured of an aggressive and competitive PCS market to the benefit of all consumers of wireless communications services.

Motorola, Inc.

August 30, 1994